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RESEARCH IN THE DEVELOPMENT AND  
UTILIZATION OF ATMOSPHERIC WATER  
RESOURCES IN MONTANA

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COMPLETION REPORT  
PROJECT NO. A-062-MONT

RESEARCH IN THE DEVELOPMENT AND  
UTILIZATION OF ATMOSPHERIC WATER  
RESOURCES IN MONTANA

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The work upon which this publication is based was supported by funds provided by the United States Department of the Interior as authorized under the Water Resources Research Act of 1964, Public Law 88-379

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## WEATHER MODIFICATION

A Year of Emphasis and Information in Montana  
1 July 1972 through 30 June 1973

A program of information and education to make Montana residents aware of the possible benefits and problems of weather modification and to emphasize the need for research to provide factual information for decision making.

The work upon which this report was based was supported in part by:

Funds provided by the United States Department of the Interior, Office of Water Resources Research, as authorized under the Water Resources Act of 1964:

OWRR Project No. A-062-MONT

Title: Research in the Development and Utilization  
of Atmospheric Water Resources in Montana

Agreement No. 14-31-0001-3826

Project Coordinator: Robert H. Yaw

Montana State University

Bozeman, MT 59715

Period: 1 July 1972 through 30 June 1973

Funds provided by Title 1 of the Higher Education Act of 1965:

Grant No. SA 7394

Title: Weather Modification Information Program

The Endowment and Research Foundation, Montana State University,  
Bozeman, MT.

The Montana Department of Natural Resources and Conservation,  
Helena, MT.

The Agricultural Experiment Station, Montana State University,  
Bozeman, MT.



## ABSTRACT

In the spring of 1972 researchers at Montana State University recognized that intense activity was in progress in several western states to develop and use weather modification techniques to increase growing season precipitation. In Montana, lack of public knowledge and awareness, in combination with a state law which inhibited cooperative research, was minimizing opportunities for the accumulation of factual knowledge of potential value to residents of the state.

A jointly funded, 1-year program of public information was established and coordinated through the Vice President for Research at Montana State University. Resources from the Endowment and Research Foundation, the Montana Department of Natural Resources and Conservation, the Water Resources Research Center, and the Agricultural Experiment Station were utilized. A grant under Title 1 of the Higher Education Act of 1965 was subsequently obtained and contributed significantly to the program. Assistance from the Cooperative Extension Service in the form of publications and local publicity was valuable in disseminating information.

This information program resulted in (1) a greatly increased awareness of weather modification and the need for research in Montana, (2) changes to the state weather modification law, (3) the availability of \$100,000 for a cooperative state-federal research program, and (4) awareness in the Montana Congressional Delegation of local interests and desires for research and problems related to "earmarked" federal funding of research.

Keywords: Weather modification\*: Education\*: Cloud Seeding: Public Opinion: Public Relations.

\* Most important keywords

Weather Modification Information Program SA 7394





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## THE NEED

It was apparent to researchers in weather modification at Montana State University in the spring of 1972 that Montana was lagging behind other states in gaining knowledge with which to develop atmospheric water resources.

Tempting suggestions of increased crop and range yield, which might result from additional moisture, were emerging in some states. Computer modeling studies and experimental verification indicated that significant increases in precipitation from individual clouds might be obtained from the seeding of individual cumulus clouds under some conditions.

Preliminary environmental studies had identified some possible problem areas. Comprehensive environmental studies were in progress in five western states. Existing evidence suggested a lack of imminent adverse environmental consequences, particularly under well designed research programs which included environmental monitoring.

The National Academy of Sciences had recognized since 1967 the effectiveness of winter cloud seeding of orographic storms in increasing snowpack. Experiments with models of individual cumulus clouds in Florida had produced substantial increases in rainfall under some conditions. Multicounty cloud seeding programs existed in North Dakota under a state law which permitted the formation of weather modification authorities. A state-county tax-supported program of cloud seeding was beginning in South Dakota and would seed 28 counties of the state in the summer of 1972. Seven million acres of agricultural land in Oklahoma were under commercial cloud seeding. Colorado was gaining knowledge of its atmospheric water resources and their management from national research programs in hail suppression and snowpack augmentation.

In this situation of expanding research and operational cloud seeding programs, much was conflicting. Successes with research related to individual clouds was easily "translated" to mean more water on the ground over large areas from cloud seeding, although large area research programs had shown mixed results. The lack of evidence concerning the results from seeding clouds during frontal, low pressure, and upslope conditions, which prevail in the northern high plains, was conspicuous to the researcher but little publicized.

Montana state government, with no expertise in weather modification, was not in a position to evaluate or react to a situation, which held possible benefits for many residents, but was fundamentally characterized by a lack of knowledge. Public information was not available in the state. Tax-supported programs in the Dakotas lent a credibility to cloud seeding, which was difficult for the "uninformed" to ignore. Cloud seeding in Montana's western mountains had become an emotional issue, and downstream water needs appeared likely to increase pressures for future programs of snowpack augmentation in the Montana headwaters of the Columbia and the Missouri Rivers.



A reputation of "uncooperativeness" in matters related to weather modification was becoming associated with Montana and appeared likely to minimize opportunities for research with federal funds. By refusing to issue a permit, the Montana Water Resources Board had terminated a poorly evaluated, federally funded operational program in the Hungry Horse area in response to public pressure. Restrictive legislation precluded active cooperation by the Natural Resources Board with either the state-supported programs of the Dakotas or federal research efforts.

To increase the probability that adequate information and knowledge would become available to provide a basis for future decisions concerning cloud seeding in Montana, a 1-year program of public information emphasizing the need for research was organized by the Vice President for Research at Montana State University.

The program was funded jointly by the Endowment and Research Foundation, the Montana Department of Natural Resources and Conservation, the Water Resources Research Center (MSU), and the Agricultural Experiment Station. A grant under Title I of the Higher Education Act of 1965 was subsequently obtained and contributed significantly to the program. Assistance from the Cooperative Extension Service in the form of publications and local publicity was valuable in disseminating information.

The program was coordinated by Robert H. Yaw, Associate Professor of Meteorology in the Department of Earth Sciences at Montana State University.



## THE PROGRAM OBJECTIVES

Four primary objectives are identified:

1. Education and motivation: To inform the public concerning weather modification emphasizing the need for research and to motivate residents and state officials to seek research funding.

Note: Material pertinent to this objective is contained in Appendix 1 concerning the Title 1 grant, its objective and evaluation.

2. Communication, cooperation, and coordination: To encourage communication, coordination, and cooperation between federal agencies, state agencies, and University researchers in matters related to weather modification: A significant factor was to provide state agencies with technical expertise available in the weather modification research group at MSU.

3. Research area identification: To informally assess public attitudes and identify groups and regions in the state interested in weather modification research.

4. Research proposal preparation: To assist researchers at Montana State University in preparing proposals for federal funding.

Note: Changes in federal funding and research policy which occurred during the period of the program significantly altered the form of this objective. The objective shifted from one of preparing proposals for federal funding to one of encouraging state government to seek a cooperative state-federal research program in Montana.

Fundamental to the manner in which the program was carried out were the concepts that:

1. Information provided must be factual and scientifically documented with published research.

2. Information provided concerning environmental, economic, agricultural, or ecological aspects of weather modification would be coordinated with researchers in the Agricultural Experiment Station working in those areas.

3. Interpretations in terms of "good" or "bad" would be avoided because the entire research area is characterized by a present lack of knowledge.

4. The thrust of the program would emphasize the need for knowledge about weather modification and its effects in Montana and not the need for cloud seeding in Montana.





## PROGRAM ACTIVITIES

To enhance the probability of reaching many individuals, several activities were conducted concurrently. These are described here and placed in an approximate time-frame in Appendix 2.

Seminars: Seminars were planned and conducted on November 20 and 21 in Billings and Helena. Over 300 participants were invited to attend including state legislators, state officials, agricultural leaders, and residents with an interest in water resources and environmental protection.

Seminars were basically the same at each location. Researchers from units of the Montana University System who were involved with weather modification research related to agriculture, ecology, environment, hydrology, sociology, economics, and meteorology presented information and answered questions.

While attendance at the seminars was small (Billings, 16; Helena, 27), newspaper publicity from them served to emphasize the broad approach to all aspects of weather modification by highly qualified researchers without individual financial interests in "promoting" cloud seeding.

Letter Contacts: Contacts were made by letter with groups throughout the state. The letter contained an offer to provide information if the groups were interested. A list of groups contacted is provided in Appendix 3. In general, the list included county commissioners, conservation district supervisors, organizations serving Montana agriculture, and civic and environmental groups.

Publications: A weekly column about weather modification was prepared and offered to all daily and weekly newspapers in the state. The column was published in papers in Glasgow, Miles City, Fort Benton, and Shelby; in addition it was carried by the Prairie Star, a paper with circulation in Choteau, Glacier, Liberty, Pondera, Teton, Toole, and portions of Hill County.

The column provided factual information concerning cloud seeding, how it is done, the successes and unknowns, and information about programs in other states. A total of 41 columns were written and distributed.

Several newspaper articles appeared as a result of (1) press releases by the Office of Information (MSU), (2) local publicity provided by groups advertising talks, and (3) reports of talks and seminars as covered by the press.

Three articles were published in the Montana Farmer-Stockman (September 21, January 4, and May 3) as a result of this program.

Radio and Television: Three 13-minute television tapes were made in cooperation with the Soil Conservation Service and the Cooperative Extension Service for use on their programs on KRTV in Great Falls. Information from two of the tapes was extracted and used on the Montana Television Network statewide evening news.



Five tapes for radio use were made in cooperation with local Cooperative Extension Service Personnel for use on their local radio programs.

Public Talks: As a result of contacts made by letter and invitations resulting from other publicity, 83 groups (Appendix 4) and a total of 2650 people were provided with information and an opportunity to ask questions.

The material presented in the talks (Appendix 5) covered the current state of the technology, reasons for cloud seeding, environmental considerations, activities in other states, and comments concerning the particular situation in Montana. The portion of the talk concerning the situation in Montana consistently emphasized (1) problems with the existing law and (2) the need for research and evaluation.

The total program time was usually slightly over one hour, depending on questions. The actual planned presentation took about 35 minutes.

State Agency Briefings: At the outset, prior to contacting any groups, state agency heads and their staffs (Appendix 6) were briefed on the objectives of the program and the information to be presented. This briefing was more comprehensive than the public talks, although the same information was presented.

Legislative Assistance: At the request of legislators drafting changes to the law, technical assistance was provided on several occasions.

Recommendations to State Agencies: During the period of this program several recommendations concerning changes to the state weather modification law, and the need for state leadership in weather modification research were made to the Director of the Department of Natural Resources and Conservation.

Information Letters: During the legislative session, on four occasions, letters were sent to 40 individuals and groups that had indicated particular interest in weather modification. The letters emphasized the current status of legislation (i.e., impending hearings, etc.) and the opportunity for them to make their views (pro or con) known.

Cooperative Extension Bulletin: A bulletin (Appendix 7) was prepared for publication and distribution by the Cooperative Extension Service. It described briefly computer cloud models, possible benefits, activities in other states, and the need for knowledge from research in Montana.



## PROGRAM RESULTS

Background: To understand the significance of the assorted activities resulting from this program, it is essential to review activities related to federal research spending in weather modification during FY 73.

At the start of the program the Division of Atmospheric Water Resources Management of the Bureau of Reclamation was spending 6.5 million dollars annually on an assortment of projects through contracts with universities, state governments, and private contractors. Much of this FY 73 funding in the Bureau's budget was "earmarked" in Congress for expenditure in certain states at universities and institutes or for particular projects. No funds were earmarked for Montana; consequently, researchers and state residents were in the position of competing for "leftovers" in the Bureau's budget.

During the period from August, 1972, through January, 1973, the National Oceanic and Atmospheric Administration was planning, advertising, and accepting bids for a site selection study to locate a multimillion dollar research program in the high plains. This program planned to study all aspects of cloud seeding in the location selected.

In February, 1973, the President's proposed FY 74 budget reduced weather modification expenditures in the Bureau's FY 74 budget to 3.25 million dollars. Concurrently the Office of Management and Budget directed the Bureau of Reclamation to start a high plains research program and directed the National Oceanic and Atmospheric Administration to drop its planning for a similar program.

The proposed budget cut and the direction to start a high plains research program forced the Bureau of Reclamation to minimize proposal-contract relationships with universities and seek cooperative state-federal relationships with state governments.

In February, 1973, the Bureau notified all contractors of the termination of funding during the summer of 1973 and contacted (Appendix 8) the governors of the high plains states to determine their interests in having a research program in their states. The letter requested an expression of interest, if any, and the degree to which the state would financially support a joint state-federal research program.

Governor Judge replied on 26 February (Appendix 9) that Montana residents were interested in weather modification research and that some state funds could probably be made available. He further directed the Department of Natural Resources and Conservation to forward to the Bureau a report (Appendix 10) of weather modification activities planned and in progress together with an assessment of research resources in Montana.

Program Evaluation: The following action has occurred as a direct result of this program and the interest and concern it has aroused.

1. The public view of weather modification in Montana has been placed in a perspective appropriate for the scientific evidence available at this time. The need for research to obtain basic knowledge necessary for future decisions has been established.



2. State leaders have become aware of the need for research and a change in the legal framework in which weather modification research is to be conducted.

A. House Bill 335 was introduced in the legislature. In the form finally passed it makes possible interstate cooperation and cooperative state-federal research. The requirement for "licensing" the federal government in matters of research has been removed. The Natural Resources Board now has the authority to make administrative decisions and cooperative arrangements in matters related to research.

Those portions of House Bill 335, which were passed, are shown in Appendix 11.

B. \$100,000 has been made available from state funds toward a cooperative state-federal research program (Appendix 12).

C. Montana has become one of four states (Wyoming, North Dakota, South Dakota, Montana) to sign a "Statement on Interstate Cooperation in Weather Modification in the Northern Plains" (Appendix 10).

3. Communications from numerous groups (Appendix 13) have indicated to the Montana Congressional Delegation both the desires of residents and the needs of the state for research in weather modification. They have also become quite aware of problems concerning the "earmarking" of federal funds.

4. Cooperation and coordination is evolving between (1) the University research group and the Department of Natural Resources and Conservation and (2) the Department of Natural Resources and Conservation and the Division of Atmospheric Water Resources Management of the Bureau of Reclamation.

A. University-Department of Natural Resources cooperation is indicated in the Department's utilization of University technical resources in the preparation of the portion of the Governor's response (Appendix 9) to the Bureau of Reclamation's letter of February 16 (Appendix 8). This response was drafted for the department by research meteorologists in the Earth Sciences Department at MSU and is included as Appendix 10.

B. State Agency-University-Agricultural group coordination and cooperation is illustrated by the cooperative planning indicated in Appendix 14.

C. State Agency-Bureau of Reclamation communication and coordination is illustrated by follow-up action taken by the Department of Natural Resources and shown as Appendix 12.

5. The Shelby-Conrad area of the Hilline has been identified as an area in which there is intense interest in weather modification and where research would be favored. Also, identified is a general lack of objection to research in the prairie portion of the state, although many might be skeptical of the ability of the technology to produce usable results. Other areas of "high" interest identified are in the vicinity of Miles City, Glasgow, and Shelby.





6. Had this program not been conducted it is highly probable that the cut in the Bureau's budget in February of 1973 together with the shift, from seeking proposals with universities, to that of dealing with state governments would have eliminated Montana from consideration for future federally funded research in weather modification. The framework for such a cooperative federal-state research program in weather modification has largely been built by this program.

Because of this program and the legal, financial, and cooperative framework that is evolving, Montana is in an excellent position to "host" a cooperative state-federal program of research, which will provide knowledge upon which to base decisions concerning weather modification in the future.

At the writing of this report it is anticipated that either two or three long term research programs to determine the complete impact of weather modification on regions of the high plains will be established and largely federally funded during the late fall of 1973. Montana is currently one of four states being given primary consideration.

If research reveals that significant increases in growing season precipitation can be obtained without adverse consequences, this factual knowledge will make possible and reasonable a decision to employ the technology operationally if residents choose.

If research reveals insignificant changes in precipitation or adverse consequences, this factual knowledge will make possible and reasonable a decision to reject the technology or pursue its development with further research.



## OBSERVATIONS AND RECOMMENDATIONS

A significant increase in initiative will be necessary from some agency of state government if federally funded weather modification research is to evolve in Montana.

This initiative will be essential during the period from 1 June 1973 through the date of site selection for research which is anticipated near December, 1973.

The initiative must be directed at coordinating state government and university resources to work with the Bureau of Reclamation's Division of Atmospheric Water Resources Management. A significant portion of this initiative must be directed at an in-state effort to inform local residents concerning the research.

Opportunities for university research through a proposal-contract relationship with the Division of Atmospheric Water Resources Management appear to be minimal unless originating as part of a cooperative state-federal high plains research program.

If Montana is not an initial participant in the cooperative high plains program, opportunities for federally funded research in weather modification would appear minimal for several years.

Agricultural groups in Montana are to be commended for their leadership in recognizing the need for research to provide factual information upon which to base future decisions.



## APPENDIX I

### TITLE I EVALUATION

While it is impossible to isolate the results which can be attributed to the Title I portion of the total program, an attempt will be made to evaluate those objectives established in the Title I program using those evaluation procedures from the original proposal which apply in light of the change in program emphasis.

It became apparent during the briefing of state officials that the prevailing "official" attitude was one of tolerance rather than one of active interest and participation. There were some exceptions to this among individuals.

Because it was possible to contribute significantly to the success of this program by "concentrating" the Title I funds with confidence building, much more time was devoted to talking with individual groups than originally planned. As the program evolved, this technique of contacting and talking with individual groups became much more significant than the seminars. The extent of this activity was indicated in the December 31 report.

Had the program been limited to the seminars as originally planned, it would have been a failure. The seminars, in combination with the talks to individual groups (and aided by other aspects of the total program), produced the results to be discussed.

The objective of the original proposal was to provide key state officials and legislators in Montana with:

1. Factual information concerning present capabilities, limitations, benefits, and problems associated with weather modification.
2. An awareness of the extent to which the new technology is being utilized and studied in the western United States today.
3. An awareness of the need to (a) identify Montana's interests in this technology and (b) determine what the technology can do in Montana.
4. Suggestions as to courses of action which are consistent with the capabilities of the technology and in the best interests of Montana residents.
5. An awareness of the need for interstate cooperation in matters related to weather modification.

Two areas of evaluation were indicated in the original proposal--the opinions of participants and MSU staff presenting material.

Participants were asked to complete a brief questionnaire at the end of the seminar concerning its value. Two thirds of the 43 individuals attending had their ideas concerning weather modification changed; one felt that the seminars were not a worthwhile activity; all agreed that research in weather modification was important to Montana.



The follow-up letter proposed in the original evaluation scheme was not used because (1) the number of participants in the seminars was small, (2) the change in emphasis from seminar to contacting individual groups, and (3) by the time letters would have gone out, legislative activities had already provided a very significant measure of the total program accomplishments.

Legislative considerations were reviewed as planned in the proposal and are presented in the section titled: Program Results.

Staff members of the Agricultural Experiment Station, Earth Sciences Department, and the College of Mineral Sciences and Technology, Butte, were requested to comment on the seminars. Their ideas can be summarized with the comment that the seminars provided useful information to those attending, but staff members were somewhat dissatisfied in the small number of people present.

The contribution of this Title 1 Grant which made possible seminars and travel for briefing individual groups cannot be overemphasized. Without this aspect of the total program, it is extremely doubtful that significant change would have resulted.





## GENERAL ACTIVITY RESUME

GENERAL ACTIVITY RESUME 1972-73

Activity	J	A	S	O	N	D	J	F	N	A	M
State Agency Briefings	*****										
Slide Presentation Preparation	*****										
Extension Bulletin Preparation	*****										
Letter Contacts Eastern Montana	*****										
Public Talks	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
Seminars Helena & Billings					*						
Letter Contacts Western Montana								*****			
Assistance to Legislators & Information Letters								*****			
State Plan Preparation									***		
Report Preparation											*****
Coordination Department of Natural Resources	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
Weather Modification Column	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
KRTV Great Falls			**						**		
Montana Farmer-Stockman Articles			*				*				*



### APPENDIX 3

#### LETTER CONTACTS WITH OFFERS FOR INFORMATION

All County Commissioners

All Montana State Conservation Districts

Montana Cattlemen's Association  
Montana Farmer's Union  
Montana Grain Grower's Association  
Montana Stockgrower's Association  
Montana Water Development Association  
Montana Wood Grower's Association  
National Farmer's Organization  
Rural Area Development Association  
Economic Development Association of Eastern Montana  
Montana Association of Conservation Districts

#### Conservation and environmentally oriented groups

Montana Wildlife Federation, (Don Aldrich, Missoula)  
Swan Citizens Conservation Council, (John King, Swan Valley)  
Montana Wilderness Association (Cecil Garland, Lincoln)  
Student Environmental Research Center (University of Montana, Missoula)  
Western Montana Scientist's Committee for Public Information (Missoula)  
Swan Valley Conservation Council (Dyce Wearnson, Seeley Lake)  
Sierra Club (Jean Warren, Missoula)  
Montana Conservation Council, Inc. (Lillian Hornick, Missoula)  
Environmental Communications Council (Wilson Clark, Billings)  
Central Montana Environmental Council (Patricia Antonick, Helena)  
Montana Wilderness Association, Flathead Chapter (Bob Muth, Kalispell)

Civic and service groups (Lions, Rotary, Optimist, Kiwanis, Chamber of Commerce and Junior Chamber of Commerce) in:

Billings	Kalispell
Great Falls	Miles City
Missoula	Bozeman

League of Women's Voters in:

Chester	Helena
Great Falls	Billings
Missoula	

Eastern Agricultural Research Center, Sidney  
Northern Plains Soil and Water Research Center, Sidney  
Northern Agricultural Research Center, Havre  
Southern Agricultural Research Center, Huntley  
U.S. Range and Livestock Experiment Station, Miles City



## APPENDIX 4

## WEATHER MODIFICATION TALKS--GROUPS AND LOCATIONS

<u>Date</u>	<u>City</u>	<u>County</u>	<u>Group</u>	<u>Present</u>
9/5/72	Ryegate	Golden Valley	CCSG	16
9/6/72	Port Benton	Choteau	CCSG	5
9/6/72	Great Falls	Cascade	Montana Farmer Stockman (Interview)	1
9/11/72	Great Falls	Cascade	Montana Farmer Stockman (Interview)	1
9/11/72	Big Sandy	Choteau	Rotary Club	23
9/18/72	Levinstown	Fergus	CCSG	26
9/18/72	Roundup	Musselshell	CCSG	5
9/19/72	Miles City	Custer	Custer County Development Association	30
9/20/72	Turner	Blaine	CCSG	23
9/21/72	Choteau	Teton	CCSG	25
9/25/72	Great Falls	Cascade	CCSG	12
9/26/72	Chester	Liberty	CCSG	5
9/29/72	Great Falls	Cascade	KRTV (Interview)	unknown
10/2/72	Winnett	Petroleum	CCSG	5
10/2/72	Lavina	Golden Valley	CCSG	27
10/3/72	Malta	Phillips	CCSG	5
10/4/72	Scoby	Daniels	CCSG	6
10/4/72	Plentywood	Sheridan	CCSG	5
10/5/72	Glasgow	Valley	CCSG	15
10/11/72	Bozeman	Gallatin	SCS Staff	16
10/16/72	Great Falls	Cascade	Kiwanis Club	57
10/17/72	Bozeman	Gallatin	Rotary Club	62



<u>Date</u>	<u>City</u>	<u>County</u>	<u>Group</u>	<u>Present</u>
10/18/72	Alzada	Carter	CCSG	3
10/18/72	Bell Tower	Carter	CCSG	None
10/19/72	Baker	Fallon	CCSG	21
10/24/72	Helena	Lewis & Clark	Agricultural Leaders for State Organizations	9
10/25/72	Bayre	Hill	CCSG	11
10/31/72	Circle	McCone	CCSG	6
11/1/72	Glendive	Dawson	Coop Extension Service Women's Group	55
11/1/72	Glendive	Dawson	Economic Development Association	22
11/3/72	Big Sky	Gallatin	Montana Water Development Association Annual Meeting	62
11/17/72	Bozeman	Gallatin	Montana Cattlemen's Association	27
11/18/72	Terry	Prairie	5th Annual Beef Forum	260
11/20/72	Billings	Yellowstone	Weather Modification Seminar	16
11/21/72	Helena	Lewis & Clark	Weather Modification Seminar	27
11/27/72	Inverness	Hill	Highline Development Association	47
11/28/72	Miles City	Custer	Chamber of Commerce	22
11/29/72	Wibaux	Wibaux	CCSG	17
11/30/72	Miles City	Custer	Lions Club	33
12/1/72	Missoula	Missoula	RAD Annual Meeting	65
12/4/72	Great Falls	Cascade	Montana Grain Grower's Annual Meeting	72





<u>Date</u>	<u>City</u>	<u>County</u>	<u>Group</u>	<u>Present</u>
12/7/72	Miles City	Custer	Staff, U.S. Range & Livestock Experiment Station	5
12/12/72	Billings	Yellowstone	Agriculture Committee, Billings Chamber of Commerce	19
12/12/72	Billings	Yellowstone	Kiwanis Club	77
1/8/73	Forsyth	Rosebud	Tongue River & Yellowstone County Action Group	23
1/10/73	Bozeman	Gallatin	RAD	12
1/11/73	Whitehall	Jefferson	Coop Extension Service	23
1/11/73	Deer Lodge	Powell	Deer Lodge Valley Conservation District	165
1/12/73	Helena	Lewis & Clark	State Legislators	4
1/13/73	Helena	Lewis & Clark	Legislators	2
1/15/73	Bozeman	Gallatin	Exchange Club	19
1/20/73	Helena	Lewis & Clark	Legislators	3
2/5/73	Missoula	Missoula	Rotary Club	67
2/6/73	Kalispell	Flathead	Bonneville Power Administrator	3
2/8/73	Missoula	Missoula	West Missoula Lions	15
2/8/73	Helena	Lewis & Clark	Natural Resources Committee, State House Representatives	25
2/9/73	Missoula	Missoula	Optimists	16
2/9/73	Missoula	Missoula	Environmental Seminar, U.M.-- Botany Department	70
2/10/73	Butte	Silver Bow	Naval Reserve Group	41
2/12/73	Hobson	Judith Basin	County Conservation District	77



<u>Date</u>	<u>City</u>	<u>County</u>	<u>Group</u>	<u>Present</u>
2/14/73	Helena	Lewis & Clark	House--State Representatives	3
2/21/73	Great Falls	Cascade	Rotary Club	123
2/24/73	Helena	Lewis & Clark	Senate Hearing	33
2/26/73	Helena	Lewis & Clark	Kiwanis Club	24
3/5/73	Broadus	Powder River	Powder River Commercial Club	33
3/7/73	Helena	Lewis & Clark	League of Women Voters National Wildlife Association	4
3/8/73	Helena	Lewis & Clark	Senate Natural Resources Committee	13
3/11/73	Helena	Lewis & Clark	President, Montana Grain Growers	1
3/20/73	Sheridan	Madison	Ruby Valley Conservation District	120
3/22/73	Conrad	Pondera	Pondera County Economic Development Association	9
3/24/73	Great Falls	Cascade	Montana Grain Growers	3
3/26/73	Great Falls	Cascade	KRTV (Interview)	unknown
3/27/73	Dillon	Beaverhead	"Ranchers Roundup"	19
3/29/73	Great Falls	Cascade	Cascade County Conservation District	200
4/2/73	Harlowton	Musselshell	Musselshell Conservation District	9
4/5/73	Conrad	Pondera	Economic Development Association of Pondera County	10
4/4/73	Helena	Lewis & Clark	Lewis & Clark Conservation District Communications	7
4/9/73	Big Timber	Sweet Grass	Sweet Grass County Conservation District Supervisors	8



<u>Date</u>	<u>City</u>	<u>County</u>	<u>Group</u>	<u>Present</u>
4/11/73	Columbus	Stillwater	Stillwater Conservation District	19
4/13/73	Trout Creek	Sanders	Green Mountain Soil and Water Conservation District	28
4/17/73	Kalispell	Flathead	Lake County Conservation District	12
4/19/73	Swan Valley	Lake	Swan Citizens Conservation Council	7
4/25/73	Great Falls	Cascade	Miracle Mile Pivonis	27
5/10/73	Helena	Lewis & Clark	Helena Sierra Club	22
5/15/73	Polson	Lake	Lake County Soil Conservation District	35
5/16/73	Ennis	Madison	Madison County Soil and Water Conservation District	24
6/5/73	Conrad	Pondera	Conrad Chamber of Commerce	72



## APPENDIX 5

### WEATHER MODIFICATION TALK

The following information was presented in a 35-minute talk using slides of graphs, charts, and bulletins from other states.

1. Silver iodide seeding of clouds colder than freezing:
  - A. Effects of silver iodide on cloud--ice nuclei and heat release.
  - B. Methods--ground generators, aircraft, rockets.
2. State of technology of winter cloud seeding:
  - A. Best developed portion: recognized by National Academy of Sciences in 1967. Recent experiments have defined conditions under which increases and decreases may occur.
  - B. More research necessary for local uses.
3. State of technology of growing season (cumulus) cloud seeding:
  - A. Cloud models and how used.
  - B. Cloud model use and verification in Florida. Substantial increases found in some cases and seeding in naturally widespread rain led to decreases or little change.
  - C. Cloud model study of western states: largest percentage (40%) increases possible in Montana and Wyoming. Possibly too optimistic: 10% increase in Montana would be about one inch of additional rainfall.
  - D. Lack of proof that increasing rainfall from individual cumulus clouds will increase water on ground over several thousand square miles.
4. Why seed clouds?
  - A. Possible economic benefits to agriculture: (see Appendix 7)
  - B. Hail suppression: less well proven than either winter or cumulus cloud seeding.
  - C. Cloud seeding and drouth mitigation: cloud seeding can never break drouth but might provide some localized relief.
  - D. Snowpack augmentation: would probably be done for downstream states and pressures for winter seeding in Montana headwaters of Missouri and Clark Fork of Columbia would probably increase.
5. Environmental considerations:
  - A. No proven adverse environmental consequences at present time and obvious benefits from additional water.
  - B. Many questions: silver accumulation, saline seep, erosion, flooding, etc.
  - C. Many universities including MSU engaged in research on environmental, agricultural, economic, ecological, and sociological aspects of cloud seeding.
6. Activities in other states:
  - A. North Dakota and weather modification authorities.
    - (1) 4-county hail suppression program.
    - (2) 3-county pilot project with large federal financial assistance.





- B. South Dakota state-county tax-supported program.
    - (1) Program growth--28 counties 1972 to 44 counties 1973.
    - (2) Lack of evaluation.
  - C. Colorado learning from two national research programs.
    - (1) National hail research experiment on northeastern prairies.
    - (2) San Juan winter seeding program in headwaters of Colorado River.
  - D. Texas: locally funded hail suppression and rainfall augmentation programs and federally funded research program.
  - E. Oklahoma and commercial cloud seeding.
    - (1) Seven million acres under some sort of seeding.
    - (2) The problem of evaluation.
  - F. New Mexico Weather Control Commission prohibits all commercial seeding but encourages research.
7. Montana problems:
- A. State law change needed to encourage research and federal-state cooperation and interstate cooperation.
  - B. Need for large area (county wide) experiments on prairie to determine what cloud seeding will do.
  - C. Need for winter research to determine all effects of seeding if done for mountain snowpack augmentation and increased downstream water.

In addition to the slide presentation two questions were so persistently asked that they should be considered a part of the presentation.

1. If you seed clouds in one place, who do you take water away from downwind?

This was consistently answered with the idea that not enough is known to give a substantial answer at present. It was pointed out that three research projects looking at this situation had found increases up to 100 to 150 miles downwind. It was suggested that making the air moister through the original seeding might make the next showers form more easily and that increased precipitation may be the result of more frequent cycling of the water.

2. Did the cloud seeding at Rapid City have anything to do with the flood?

This was consistently answered by giving the results of the commission appointed to study the situation by the governor of South Dakota which pointed out:

- a. The flood would have been as bad had the seeding not been done.
- b. The area has flooded every ten years and as much water had come down in some past floods. Excessive damage and loss of life resulted from the increased use of land subject to flood damage.



## APPENDIX 6

### STATE AGENCIES BRIEFED

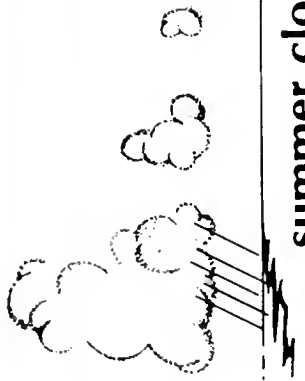
As a portion of the planned information program and prior to the approval of the Title 1 grant, state agencies were briefed on the nature of the program:

<u>Date</u>	<u>State Agency</u>	<u>Contact</u>
July 19	Fish and Game Agriculture	Jim Positwitz George Lachman
July 20	Health Planning and Economic Development	Ben Wake Perry Ruggs
July 24	Public Lands	Ted Schwinden
July 25	Conservation Districts	Ole Ueland
August 4	Forestry	Bob Arnold

Briefings were given to individuals listed and staff members available.

NOTE: The Department of Natural Resources and Conservation was not included because it was aware of the program and contributing financial support. The Natural Resources Board was briefed much later in the year.





## summer cloud seeding

# WHAT ABOUT IT?

APPENDIX 7



## Montana needs to know

### MONTANA NEEDS

#### Knowledge:

From county-size controlled field experiments which are critically evaluated.

From applied research.

Cloud seeding techniques effective in central Montana cannot be learned in Florida or the Dakotas.

#### Changes in State Law:

The present Montana Weather Modification Law has good points: However,

It is basically for control.

No state agency is charged with finding out what cloud seeding can do for Montana agriculture.

No funds have ever been appropriated for administering the law.

It inhibits research by making reciprocal cooperation with neighboring states difficult.

This folder provides information about:

1. The present status of cloud seeding.
2. Its potential in Montana, and
3. Activities in neighboring states.

Additional information may be obtained from Bob Yaw, Earth Sciences Department, Montana State University, Bozeman, Montana 59715.

### WHO'S SEEDING CLOUDS?

**North Dakota:** State law permits counties to form weather modification authorities. In one project 3 counties together collect \$48,000 annually and receive \$225,000 in federal aid to conduct a combined research-rainfall augmentation program.

**South Dakota:** Appropriations from the state general fund are used in combination (75%-25%) with taxes from local weather modification authorities to conduct statewide summer cloud seeding.

**Florida:** NOAA scientists using cloud models to select favorable seeding days, find average increases of 100% from seeding individual cumulus clouds with average increases near 400% on days that were not naturally rainy.

**Kansas:** \$100,000 was appropriated by the state legislature for cloud seeding research and rainfall augmentation during 1972.

### WHAT ABOUT ENVIRONMENT?

At this time there are no proven adverse environmental effects from growing season cloud seeding.

Key current concepts:

Environmental monitoring is essential. Change (if any) will be slow. There is time to learn.



SALT AND SILVER

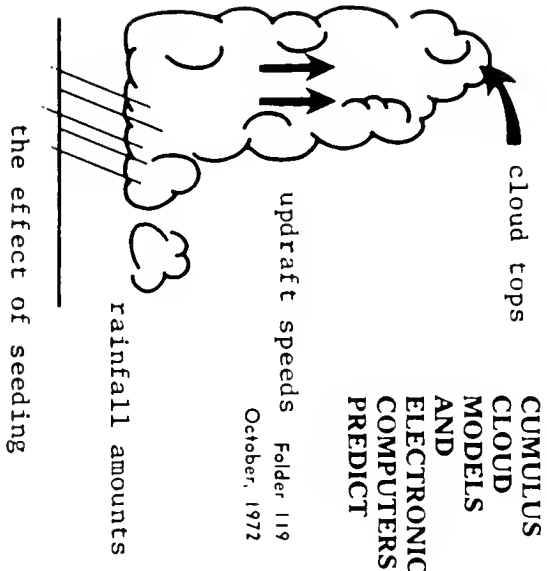
Silver iodide seeding can either increase, decrease, or make no change in rainfall from individual summer cumulus clouds.

Salt seeding may make possible the increasing of rainfall from clouds which cannot be seeded with silver iodide.

SO WHAT'S NEW?

Cumulus cloud models and electronic computers now make possible the selection of situations in which:

- 1. Silver iodide seeding will probably result in rainfall increase.
- 2. Salt seeding will probably result in rainfall increases.

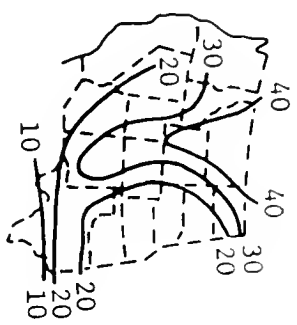


Issued in furtherance of cooperative extension work in agriculture and home economics by the United States Department of Agriculture, in cooperation with the United States Department of Agriculture, Extension Service, Bozeman, Montana.

HOW MUCH MORE WATER?

A computer study of individual cumulus clouds using a cloud model and actual growing season weather information for two seasons indicates for Montana:

- 1. No change or decreased rainfall from silver iodide seeding on about three quarters of the days.
- 2. Increases of near one quarter of an inch from silver iodide seeding on the remaining quarter of the days.



Computer predicted rainfall increases from cloud seeding in the western United States expressed as a percentage of natural growing season rainfall.

While 40% increases for Montana may be overly optimistic, only a 10% to 15% increase would mean an additional inch of water for most of eastern and central Montana.

ESTIMATED BENEFITS FROM ONE ADDITIONAL INCH OF GROWING SEASON RAINFALL

Crop	Probable Yield Increase	Crop Value	Income Increase on 1000 Acres of Cropped Land
Wheat	2 bu/acre	\$1.20 bu	\$2400
Barley or Oats	2 bu/acre	\$ .70 bu	\$1400
Hay	150 lb/acre	\$10. ton	\$ 750
Grazing Forage	50 lb/acre	\$5. ton	\$ 125
Cost of seeding 1000 acres as part of a large area seeding program at \$.04 per acre			\$ 40







United States Department of the Interior  
BUREAU OF RECLAMATION

ENGINEERING AND RESEARCH CENTER

P.O. BOX 25007

BUILDING 67, DENVER FEDERAL CENTER  
DENVER, COLORADO 80225

*Chubb  
Paul Reclamation  
Barre District*

IN REPLY  
REFER TO: 1200  
470.1

FEB 16 1978

Hon. Thomas L. Judge  
Governor of Montana  
Helena, MT 57601

RECEIVED  
GOVERNMENT OFFICE  
HELENA, MONTANA

Dear Governor Judge:

The Bureau of Reclamation has been assigned the responsibility for mounting in the High Plains Region an experimental program to test the scientific concepts of precipitation augmentation. A sum of \$1,000,000 has been included in the President's Budget for FY 1974 for initiating this effort as part of "Project Skywater." We intend to conduct this program cooperatively in an environment conducive to its success. We envision a program of several years' duration. It will be planned, organized, and conducted with a high regard for both the desires of people living in and near the experimental area, ecological concerns, Federal-state cooperation, and the scientific requirements for reducing the uncertainty that has characterized this field.

Our planning is in a very preliminary stage. Selection of the site or sites where this program will be carried out will be made after consideration of the availability of all possible supportive resources. Included will be the nature and degree of local interest, freedom from conflicts with existing programs, observational data collection and processing facilities, state agencies interested in a cooperative role, minimum adverse environmental impact, and the predisposition to cost sharing.

Interest in the program is widespread. Each Governor of a High Plains State is being notified about this opportunity. An indepth appraisal of the resources related to conducting all or part of this experiment within the boundaries of your State is earnestly desired.

Sincerely yours,

*Archie M. Kahan*

Archie M. Kahan, Chief  
Division of Atmospheric Water  
Resources Management

100  
100  
100

State of Montana  
Office of The Governor  
Helena 59601

THOMAS L. JUDGE  
GOVERNOR

February 26, 1973

Mr. Archie M. Kahan, Chief  
Division of Atmospheric Water  
Resources Management  
U. S. Department of the Interior  
P. O. Box 25007  
Building 67, Denver Federal center  
Denver, Colorado 80225

Dear Mr. Kahan:

Montana is vitally interested in participation in any program concerning weather modification.

I appreciate your notification of federal government proposals with regard to weather modification in the High Plains Region.

I have requested the Department of Natural Resources and Conservation to forward a report on weather modification activities contemplated or underway in Montana.

The Montana Legislature is considering a proposal to permit counties to levy up to two mills for the support of cooperative weather modification programs. Such a program could generate considerable resources to serve as matching funds for any federal monies which may become available.

Furthermore, I believe some direct state funds could be made available to participate in any cooperative experimental program.

I look forward to learning more about the Bureau's proposals, and assure you this Administration will cooperate.

Sincerely,

THOMAS L. JUDGE  
Governor

cc: ✓ Gary Wicks  
Representative Jack Gunderson  
Senator Bill Bertsche

RECEIVED  
FEB 27 1973  
MONTANA DEPARTMENT OF NATURAL  
RESOURCES AND CONSERVATION





# MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

THOMAS L. JUDGE, GOVERNOR  
GARY WICKS, DIRECTOR

MEMBERS OF THE BOARD  
JOSEPH W. SABOL, CHAIRMAN  
DEAN HANSON  
RILEY OSTBY

449-3647  
SAM W. MITCHELL BUILDING  
HELENA, MONTANA 59601

March 20, 1973

Dr. Archie Kahan, Chief  
Division of Atmospheric Water  
Resources Management  
U. S. Department of the Interior  
P. O. Box 25007  
Building 67, Denver Federal Center  
Denver, Colorado 80225

Dear Dr. Kahan:

Governor Judge has asked me to forward information concerning weather modification activities in Montana in response to your letter of February 16, 1973.

This brief report summarizes our point of view concerning weather modification activities in eastern and central (prairie) Montana. It suggests certain directions of research which appear to be needed and are of value to the high plains in general.

Although the actual dollar amount of direct state funding which can be allotted to this purpose must be decided by the Legislature, certain resources are suggested which would be of value and are available.

If you require additional information, please contact me.

Sincerely,

GARY J. WICKS, DIRECTOR  
DEPARTMENT OF NATURAL  
RESOURCES AND CONSERVATION

GJW/nw



## WEATHER MODIFICATION IN MONTANA

Background Information

Montana Needs

Resources for Research

Research Direction

Activities

Appendices

Prepared March 20, 1973 at the request of Governor Judge  
for transmission to the Division of Atmospheric Water  
Resources, Bureau of Reclamation.

Prepared by the Montana Department of Natural Resources and  
Conservation in coordination with researchers in weather modification  
at Montana State University.





## BACKGROUND INFORMATION

There is an awareness in Montana of:

1. Successes which have been achieved in increasing rainfall from individual summer clouds in some locations using ice phase seeding and cloud models for guidance:
2. Successes which have been achieved in snowpack augmentation through seeding orographic storms:
3. Evidence from some experiments suggesting that increases in rainfall can be achieved over an area from seeding some cloud systems with silver iodide:
4. Suggestions that hail can sometimes be suppressed using silver iodide seeding. Also, that research is in progress at the National Hail Experiment because of the questions currently unanswered relating to hail suppression:
5. Successes claimed and the little available experimental evidence concerning hygroscopic seeding:
6. The growing body of factual information documenting (1) the substantial value of additional moisture at proper times to agriculture and (2) the need and desire for more information relative to environmental impacts from cloudseeding.
7. The need for interstate cooperation in research and future operational programs: (we are attempting to implement the Statement of Interstate Cooperation in Weather Modification in the Northern Plains, Appendix I.)
8. The emphasis placed on the need for knowledge and evaluation by the National Academy of Sciences at this state of the technology development:
9. The complete lack of knowledge concerning the effects of seeding the synoptic scale features which provide the precipitation for the basic water supply in spring which makes agriculture possible in the high plains:
10. A substantial and growing interest in central and eastern (prairie) Montana in determining what weather modification can do to augment precipitation of interest to agriculture:



BACKGROUND INFORMATION (Continued)

Our awareness of these factors, in combination with our assessment of public attitude in eastern and central (prairie) Montana, leads us to believe that there is a need for knowledge which can be obtained from county-size (few thousand square miles) controlled experiments which are critically evaluated.

We visualize certain "needs" or questions requiring answers in the high plains if we are to provide the residents and governmental officials of a region with information upon which they can base their decisions.



## MONTANA NEEDS:

If weather modification is to evolve in the Montana portion of the high plains, much additional knowledge is essential.

This would include answers to such questions as:

1. Does increasing rainfall from individual cumulus clouds result in more water on the ground over large areas?
2. What can precipitation enhancement techniques do to augment spring and fall precipitation resulting from frontal and cyclonic storms?
3. To what extent and with what success do cloud models provide reasonable guidance in the western portions of the Northern high plains?
4. Can a management plan be devised which optimizes benefits for an agricultural region with a major crop and several other minor crops without unacceptable adverse consequences to the minor crops (i.e., an irrigated area with specialty crops within a large area of dry land wheat)?
5. What are the downwind effects of seeding over a large area?
6. What standards should be established for environmental monitoring to insure the identification of unexpected impacts?

Possibly it is appropriate to note that public acceptance of a program in eastern Montana could be a major factor in determining the attitudes of individuals in the mountainous portions of the state toward future weather modification programs.



## RESOURCES FOR RESEARCH

In addition to any direct state funding which may be made available, the following should be considered in evaluating the possibility of a cooperative program.

Public Interest: There is a growing public interest in the plains of Montana in determining what weather modification can do. This interest has been stimulated by a public education program conducted jointly by Montana State University and Department of Natural Resources and Conservation with the objective of providing factual information concerning the status of weather modification, what its potentials may be, and what other states are doing.

Several groups including the statewide Rural Area Development Committee, and Economic Development Association of Eastern Montana (18 counties), and specialized agricultural organizations have pushed for a change in the existing weather modification law which would authorize the Natural Resources and Conservation Board to exempt research activities from license permit requirements.

Research Orientation: While interest is high and growing in Central and Eastern Montana, there is an awareness that several uncertainties exist and that there are several questions concerning large operational programs which do not have valid answers at present. There is concern for the environment but it is in balance with the possible benefits which could emerge from the application of a proven technology over a large area.

Legal Framework: Existing Montana law provides an adequate framework for research and proposed changes will provide a better one. Weather modification is under the control of the 5 man Natural Resources and Conservation Board which controls licensing and the issuance of permits. University researchers have found that this framework has not been unduly restrictive.

If proposed changes are enacted into law, the Board would have the authority to make rules exempting all research from license and permit requirements. The extent to which the Board would utilize this authority can not be stated at this time. As a generalization, the Board would probably require a public hearing in the area effected for any large scale program....but not necessarily each year.

Authority exists for control to prevent conflicting programs from originating during the period of time that research is being conducted.

State Agency Cooperation: It is anticipated that any cooperative program which might emerge would be with the Department of Natural Resources and Conservation and conducted through Montana State University. During this past year close cooperation and coordination have developed between the Department of Natural Resources and Conservation and Montana State University and it is felt that a sound foundation for future cooperation exists.





## RESOURCES FOR RESEARCH (Continued)

Other state agencies have indicated interest in the research program in weather modification.

Technical Competence: Since 1967, researchers in the Earth Sciences Department at Montana State University have been developing a competence in weather modification technology. They have demonstrated a capability for managing resources, conducting large field experiments, and cooperating with concerned agencies and groups.

In the last three years a competence in investigating the environmental, ecological, agricultural, economic, and sociological problems related to weather modification has developed in the Agricultural Experiment Station.

The Cooperative Extension Service Director views weather modification as having great potential value and has been very cooperative and helpful with the information program conducted during the past year. This assistance has been in the form of staff assistance from county agents and publication of an extension bulletin on cloud seeding. It is expected to continue and grow with future programs.

Congressional Assistance: As interest in weather modification has grown in the state during the past year, the federal congressional delegation has responded. Frequent communications from state officials, private individuals and interested groups have made them well aware of Montana's interests, and they have indicated their willingness to help in the development of the technology in any way they can.



## RESEARCH DIRECTION

The following is suggested as a possible direction for research which would fill Montana needs and contribute to an understanding of weather modification in the high plains.

Objective: Determine the total effect (year round) of a selected cloud seeding treatment (or treatments) in modifying natural precipitation and identify the meteorological conditions under which the treatment would increase, decrease, or not change natural precipitation.

Area: An area of about 50 miles on a side (two to three thousand square miles) would be selected, instrumented and used for research. (See Appendix 2).

Instrumentation: This would be highly contingent upon funding. A gage network with a density near one per ten square miles would be considered basic. Rawinsonde capability and tracking radar capability for use with pilot balloons and plume tracing would be essential. Seeding capability would include ground generators and airborne facilities.

Duration: It is anticipated that the program would take five years to provide definite information of the capability of the technology.

Design: Basically a randomized crossover to provide the maximum probability of determining results in a minimum of time. Additional physical experiments to gain an understanding of physical processes would be conducted to the maximum extent permitted by funding levels.

Environment: Some form of environmental monitoring dependent upon conclusions of in-progress research.

Schedule: Year 1: Program design, climatological studies, area selection, gage network installation, public relations, diffusion studies, etc.

Year 2:

- 3: Randomized program, data collection,
- 4: experiments as funding permits.

Year 5: Data analysis, evaluation, reporting

Cost: Between \$400,000 and \$500,000 per year.



ACTIVITIES

APPENDIX 10

In Progress:

1. Montana State University: (Bureau of Reclamation funding)

Researchers at Montana State University are in the final states of three projects: (1) A snowpack augmentation study in the Bridger Range, (2) a limited study of the application of cloud models in Montana, and (3) a study of environmental impacts of growing season rainfall augmentation.

2. Johnson Flying Service, Missoula: (Private funding-Airlines)

An operational program for the suppression of cold fog at the Missoula airport has been in effect for the past three years and is expected to continue.

3. Institute of Atmospheric Sciences, Rapid City, South Dakota  
(Federal and North Dakota County funding)

The Institute holds a license to seed in Montana but has not applied for a permit to seed in eastern Montana for the purpose of suppressing hail and augmenting precipitation in North Dakota. (permit required under present law)

Planned:

1. No state plans exist other than those which may emerge from a cooperative program with the Bureau of Reclamation's Division of Atmospheric Water Resources Management.
2. The current "position paper" for Bonneville Power Administration indicates that seeding in the Hungry Horse area may be commenced after November of 1975. Sensors and telemetry related to such a project have been maintained and are currently operational.

The program is in conflict with current regional forest service directives relating to wilderness area management and is strongly opposed by the local residents; therefore, the future status of the project is uncertain.



APPROX 10

MAR 12 1973

MONTANA DEPARTMENT OF NATURAL  
RESOURCES AND CONSERVATION

STATEMENT ON INTERSTATE COOPERATION IN WEATHER MODIFICATION IN  
THE NORTHERN PLAINS

Background

The Northern Plains Precipitation Management Committee is a working committee composed of the Governor's representative from the individual states of Montana, North Dakota, South Dakota, and Wyoming. The initial draft of the current statement was agreed to by members of the committee in their meeting in Denver, Colorado on 3 March 1972, following the conclusion of Skywater Conference VII, which reviewed plans for possible precipitation management programs for the northern plains. The current statement was reviewed again in December 1972, and is presented to enhance interstate cooperation in future weather modification programs in the northern plains.

THE FOLLOWING BACKGROUND FACTORS ARE NOTED:

1. With support from the Bureau of Reclamation's "Project Skywater" and other federal agencies, progress has been made in research into weather modification problems in the northern plains states. These research results underpin current widespread interest and efforts at development of weather modification for beneficial use.
2. Research results from Montana and Wyoming and elsewhere are confirming that snowpack can be increased by seeding winter clouds over mountains at the proper times.
3. Recent research has indicated that selective seeding can increase growing season precipitation from individual clouds and groups of clouds, and that silver iodide seeding can reduce hailfall in some situations. Computer models of clouds are available to aid in selection of clouds for treatment and seeding systems are available to effectively accomplish the seeding.
4. Uncertainties on the effects of cloud seeding increase with increasing size and complexity of weather systems, and continued field experiments are needed to evaluate effects of seeding on larger weather systems.
5. Success in weather modification to modify precipitation or to decrease hailfall damage has potential for a net economic benefit to the northern plains. Direct benefits in agricultural production from one inch of additional rainfall are estimated at





several bushels of grain or a hundred pounds or more of forage per acre. Preliminary estimates indicate that annual gross benefits may exceed \$20 million per state.

6. Members of the committee have met on four occasions to consider problems in weather modification common to each of the several states and to discuss mechanisms for interstate coordination and cooperation. Plans for weather modification in the northern plains were reviewed at a public meeting in Rapid City in August 1971.
7. Draft plans for precipitation management programs for the northern plains were reviewed by scientists and interested individuals at Skywater Conference VII in Denver in March 1972. The consensus of the conference was that a basis exists for moving ahead toward useful application in the northern plains, but that a need for evaluation studies and for research and development will continue.
8. Programs of environmental monitoring are desirable and often necessary to identify changes, both favorable and adverse, resulting from weather modification activities, and for controlling operations.
9. Local interests in utilizing weather modification exist in each of the four northern plain states. The State of South Dakota appropriated \$250,000 for an application program in weather modification for fiscal year 1973. An association of county weather modification authorities has been formed in North Dakota to promote further development of weather modification activity in that state. Interest in exploring the potential for beneficial use of weather modification is increasing in Montana and Wyoming.

IT IS CONSIDERED OPINION OF THE COMMITTEE MEMBERS THAT:

1. Research on precipitation management should continue with emphasis not only on modifying rainfall, snowfall, and hail damage, but also upon downwind effects and side effects having economic, environmental, and ecological consequences.
2. Utilization of weather modification must be based on local participation and decisions by representatives of those affected.
3. Local initiatives and funding will hasten applications of weather modification technology.



4. Federal support is necessary for research and development, and is desirable for evaluating, monitoring, and assisting weather modification programs.
5. The Bureau of Reclamation's "Project Skywater" is to be commended highly for past support of research and development of weather modification technology in the northern plains, and for cooperation in planning for long-range application programs.
6. The individual institutions and personnel that have worked to develop weather modification technology and its possible effects under contract with the Bureau of Reclamation are to be commended for their efforts. These include the state universities of Montana, North Dakota, South Dakota, and Wyoming, the Institute of Atmospheric Sciences at the South Dakota School of Mines and Technology, the South Dakota Weather Control Commission, and private businesses.
7. Each state is encouraged to proceed with the necessary planning, organization and funding arrangements to permit it to initiate and regulate such weather modification programs as are deemed desirable and appropriate for the state within the northern plains.
8. The committee members encourage interstate cooperation for further research and development on applied weather modification programs as this new technology matures.
9. This committee encourages widespread public distribution of this statement and solicits comments and suggestions.

NORTHERN PLAINS PRECIPITATION MANAGEMENT  
COORDINATING COMMITTEE:

  
\_\_\_\_\_  
Gary Wicks  
Governor's Representative of Montana

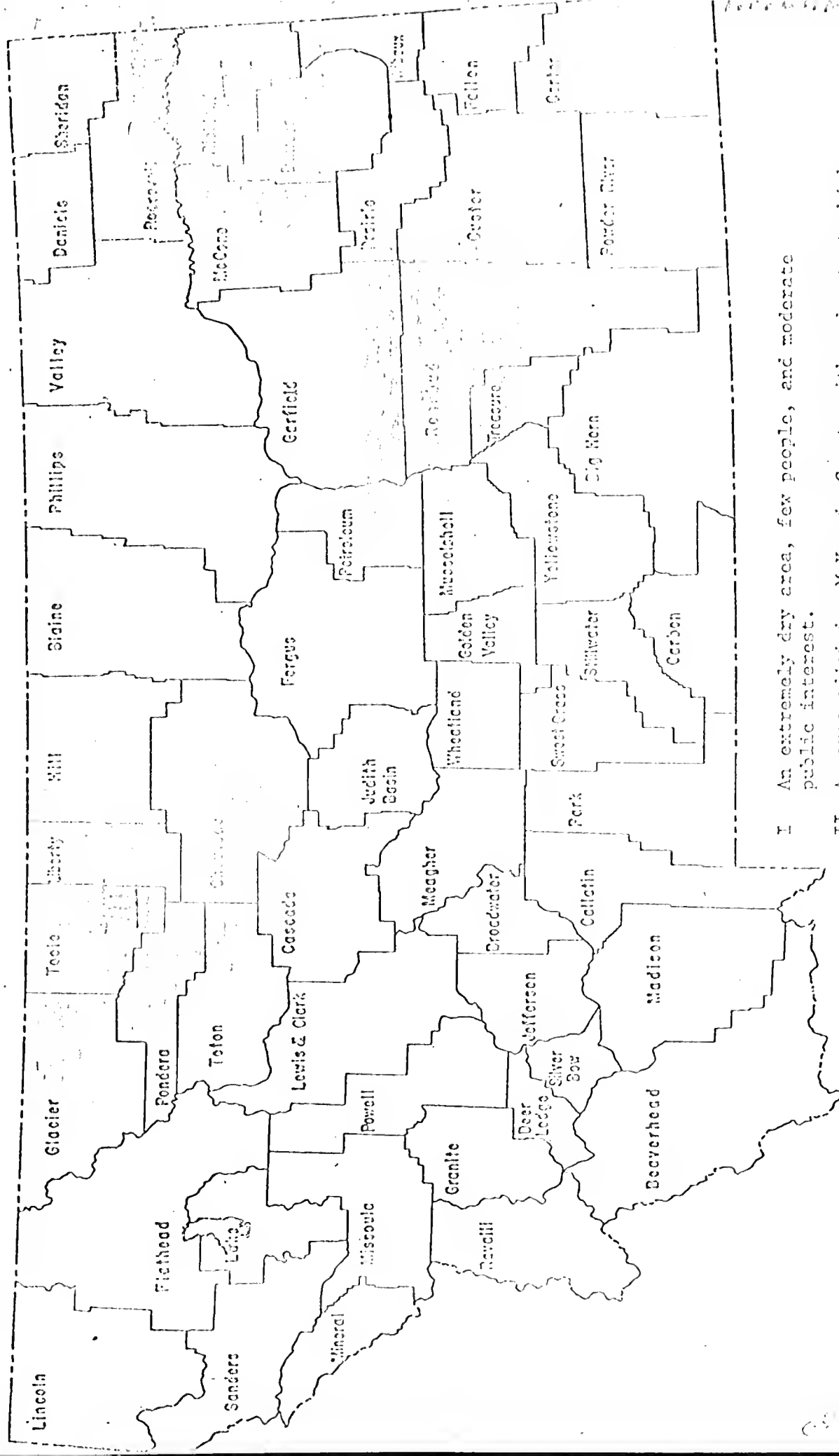
\_\_\_\_\_  
Harold G. Vavra  
Governor's Representative of North Dakota

\_\_\_\_\_  
Ed Glasgow  
Governor's Representative of South Dakota

\_\_\_\_\_  
Myron Goodson  
Governor's Representative of Wyoming

12 March 1973





Scale 6" Miles

0 10 20 30 40 50

- I An extremely dry area, few people, and moderate public interest.
- II An area adjoining McKenzie County with moderate to high public interest and an opportunity for a cooperative project with North Dakota.
- III An area of extremely high public interest, a history of private commercial seeding efforts, and high value wheat land.



House BILL NO. 385

INTRODUCED BY

Rep. Jacobson  
Rep. Jacobson, Eddins, Ulmer, Murphy  
89-310, 89-312, 89-314, 89-318

A BILL FOR AN ACT ENTITLED: "AN ACT AMENDING SECTIONS  
89-310, 89-312, 89-314 AND 89-318, R.C.M. 1947; ADDING NEW  
PROVISIONS BROADENING THE SCOPE OF WEATHER MODIFICATION BY  
CREATING COUNTY WEATHER MODIFICATION AUTHORITIES; AND  
AUTHORIZING MORE EXTENSIVE RESEARCH AND DEVELOPMENT OF  
WEATHER MODIFICATION."

BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF THE STATE OF  
MONTANA:

Section 1. Section 89-310, R.C.M. 1947, is amended to  
read as follows:

"89-310. Weather-modification-defined Definitions. As  
used in this act unless the context clearly indicates  
otherwise:

(1) "Weather Weather modification and control" means  
changing or controlling, or attempting to change or control,  
by artificial methods, the natural development of any or all  
atmospheric cloud forms or precipitation forms which occur  
in the troposphere.

(2) "Research and development" means the study





analysis, exploration and experimentation, and the extension of investigative findings and theories of a scientific and technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials, and processes.

(3) "Department" means the department of natural resources and conservation, as provided in title 32A, chapter 15.

(4) "Qualified electors" means the qualified electors of a county having a title interest in real property located outside the limits of incorporated cities and towns of the county.

Section 2. Section 89-312, R.C.M. 1947, is amended to read as follows:

"89-312. ~~Advisory--committees--to--acquire~~  
Acquisition of property -- acceptance and expenditure of funds -- research and development authority. In addition to any other acts authorized by law the board Department may:

~~(1) establish advisory committees to advise with and make recommendations to the board concerning legislation, policy, administration, research, and other matters;~~

(2) (1) acquire materials, equipment and facilities as are necessary to perform its duties under this act;



1           ~~(3)~~    (2)    receive any funds which may be offered or  
2   become available from federal grants or appropriations,  
3   private gifts, donations, bequests, or any other source and  
4   unless their use is restricted, may expend the funds for the  
5   administration of this act;

6           (3)    make such studies and investigations, and obtain  
7   such information as the department may deem necessary in  
8   exercising its authority in the administration or  
9   enforcement of this act;

10          (4)    cooperate with public or private agencies in the  
11   performance of the department's functions or duties in  
12   furtherance of the purposes of this act;

13          (5)    represent the state in any and all matters  
14   pertaining to plans, procedures or negotiations for  
15   interstate compacts relating to weather modification and  
16   control;

17          (6)    enter into cooperative agreements with the United  
18   States government or any of its agencies, or with the  
19   various counties and cities of this state or with any  
20   private or public agencies for conducting weather  
21   modification or cloud seeding operations;

22          (7)    act for and represent the state and the counties,  
23   cities and private or public agencies in contracting with  
24   private concerns for the performance of weather  
25   modifications or cloud seeding operations; and



(8) conduct and may make arrangements including contracts and agreements for the conduct of, research and development activities relating to:

(a) the identification and evaluation of meteorological, environmental, ecological, agricultural, economic, hydrological and sociological impacts of weather modification in Montana;

(b) the theory and development of methods of weather modification and control, including processes, materials and devices relating thereto;

(c) the utilization of weather modification and control for agricultural, industrial, commercial, recreational and other purposes;

(d) the protection of life and property during research and operational activities."

Section 3. The department may establish by rule standards and instructions to govern the carrying out of research and development or projects in weather modification and control as it deems necessary or desirable to minimize danger to health, safety, welfare or property.

Section 4. Section 89-314, R.C.M. 1947, is amended to read as follows:

"89-314. Board to review applications -- establish from--for--requirements exceptions. The board shall review all applications for weather modification activities,



activities and may provide by rule for exempting from the  
 licence and permit fees requirements of this act:

- (1) research <sup>and</sup> development, and experiments by state  
 and federal agencies, institutions of higher learning and  
 bona fide nonprofit research organizations and their agents;
- (2) laboratory research and experiments;
- (3) activities of an emergency character for  
 protection against fire, frost, sleet, or fog; and
- (4) activities normally engaged in for purposes other  
 than those of inducing, increasing, decreasing, or  
 preventing precipitation or hail."

Section 5. Section 39-318, R.C.M. 1947, is amended to  
 read as follows:

"39-318. Issuance of permits -- requirements for  
 permit. The permits shall be issued in accordance with  
 procedures and subject to conditions the board may by rule  
 establish to effectuate the provisions of this act, only:

- (1) if the applicant is licensed pursuant to this  
 act;
- (2) if sufficient notice of intention is published  
 and proof of publication is filed as required in section 13  
 [39-322] of this act;
- (3) if an applicant furnishes proof of financial  
 responsibility in an amount to be determined by the board as  
 required in section 14 [39-323] of this act;





(4) if the fee for the permit is paid as required in section 15 [89-324] of this act;

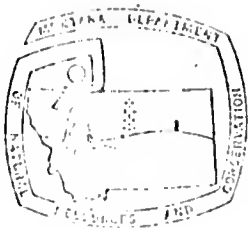
(5) if the weather modification and control activities to be conducted are determined by the board to be for the general welfare and the public good;

~~(6) if the board has held an open public hearing in the area to be affected as to such assistance~~

A public hearing may be held in the area to be affected by the issuance of the permit, if the department determines that such a hearing is necessary."

Section 6. (1) A weather modification authority <sup>(OF AILLE AND SON KENTON)</sup> shall be created by resolution and five (5) commissioners <sup>HUTTON AT THE TOWN DLD</sup> appointed thereto for five (5) year terms of office, by the board of county commissioners after fifty-one percent (51%) of the qualified electors, as determined by the vote cast for the office of governor at the last preceding general election, shall petition the board of county commissioners of their county to create a countywide weather modification authority. The board of county commissioners shall appoint five (5) commissioners to the weather modification authority, who are residents of their county, and whose names are set forth in the petition and designated by the petitioners to be appointed weather modification authority commissioners, provided that said petition has been filed by the county commissioners to have met the requirements of





RECORDED 12  
MONTANA DEPARTMENT OF NATURAL  
RESOURCES AND CONSERVATION

THOMAS F. JUDGE, GOVERNOR  
GARY WICKS, DIRECTOR

MEMBERS OF THE BOARD  
JOSEPH W. SAROL, CHAIRMAN  
DEAN HANSON  
KILLY OSTBY

440-5647  
SALT W. HITCHEL, CLERK  
HELENA, MONTANA 59601

April 6, 1973

Dr. Archie Kahan, Chief  
Division of Atmospheric Water Resources Management  
U.S. Department of Interior  
P. O. Box 25007  
Building 67, Denver Federal Center  
Denver, Colorado 80225

Dear Dr. Kahan:

In Governor Judge's letter of February 26th and the supplementary material forwarded from this office on March 20th, it was noted that limited state funds may be available for a cooperative weather modification research program with the Division of Atmospheric Water Resources Management. Although the exact amount will be dependent upon the particular program which evolves, recent indications are that up to \$100,000.00 could be so directed. However, an estimation of the probability of a cooperative program's being initiated in Montana would be of great significance at this time.

First, the specified amount of state funds, alone, will apparently be insufficient to finance a substantial research program. Therefore, if federal participation will not be forthcoming in fiscal year 1974, these funds will probably be utilized for purposes other than to begin an inadequate program.

Secondly, a weather modification research team now is assembled at Montana State University, but a decision to maintain or disband this group is dependent on the possibility of a cooperative research program. All staff contracts for the coming year must be processed and executed prior to April 30th, and members of the research staff and the University administration need a basis on which future plans can be formulated.

For these reasons, I would appreciate any indication you can give of the likelihood of a cooperative weather modification research program in Montana. I look forward to hearing from you.

Sincerely,

*Gary J. Wicks*  
GARY J. WICKS, DIRECTOR  
DEPARTMENT OF NATURAL  
RESOURCES AND CONSERVATION

GJW/nw



## APPENDIX 13

### ORGANIZATIONS REACTING

In response to this information program, several groups reacted by expressing concerns to state legislators, agencies of state government, and members of the Montana Congressional Delegation.

It is not possible to identify all of the organizations reacting, but the following is a partial listing.

Montana Grain Grower's Association

Rural Area Development Association

Montana Association of Conservation Districts

Economic Development Association of Eastern Montana

Montana Water Development Association

Economic Development Association of Pondera County

Phillips County Economic Development Association

Custer County Economic Development Association

Toole County Development Association

Billings Chamber of Commerce

Miles City Chamber of Commerce

Wibaux County Board of County Commissioners

Montana Quality Commodities, Inc., Glasgow





State of Montana  
Office of the Governor  
Helena 59606

May 3, 1973

ADDRESSEES:

Jack Gunderson, Montana State House of Representatives  
George Lackman, Montana Commissioner for Agriculture  
Dorothy Eck, Federal State Coordinator, Governor's staff  
Joe Asleson, Dean of Agriculture, MSU  
Bob Brastrup, Executive Secretary, Montana Wheat Research  
and Marketing Committee  
Arlin Super, Professor of Meteorology, MSU

Mr. Bob Yaw  
Montana State University  
Traphagen Hall  
Bozeman, Montana 59715

Dear Mr. Yaw:

Jim Stephens, President of the Montana Grain Growers, has asked that I call together a group of individuals who are vitally interested in the future of weather modification in Montana.

You are invited to attend a meeting on May 10, 1973 at 10:00 a.m. in the Governors' Reception Room in Helena, Montana.

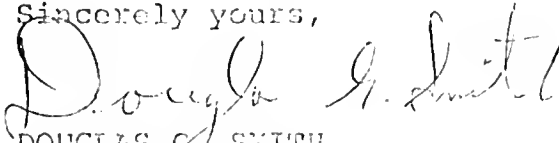
We need your answers and input to some of the following questions:

1. What should be done with the \$50,000 the Montana Wheat Research and Marketing Committee has appropriated for weather modification research?
2. Who will be testifying in support of weather modification in Montana?
3. How do we develop strategy to bring the Bureau of Reclamation High Plains experiment on weather modification to Montana?

We cannot stress the urgency enough of this meeting. Either we take action or this project will go to some state other than Montana who expresses more interest.

These will be some of the topics that will be discussed and we look forward to your comments and suggestions.

Sincerely yours,

  
DOUGLAS G. SMITH  
Agricultural Coordinator  
Office of the Governor







